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Description

Pollen or insect screen for applying to openings in buildings such as windows, doors or similar

This invention relates to pollen or insect screens for applying to openings in buildings such as windows, doors or similar.

Flyscreens are installed to protect against insects by preventing their entry. They consist of a fastening system such as mushroom tape and a tulle. There are flyscreens for windows, skylights and doors, but also for perambulators and children's beds. Flyscreens are commercially obtainable with tulle which is dark (black, anthracite), light colored (white) or else color printed, especially with motifs.

During the day, flyscreens comprising black tulle are virtually invisible from the inside; flyscreens comprising white tulle offer protection from prying eyes similar to a net curtain; and flyscreens bearing colored motifs look very decorative.

The incidence of pollinosis (hay fever), i.e., the allergic response of the mucous membranes of the eye and of the upper and lower respiratory tracts to flower pollen and other airborne allergens, in the population has been monitored in Germany for a number of years. It is found that about 11% to 15% of the population is affected. The allergic response of a pollen allergy usually manifests itself in reddening and lacrimation of the eyes (conjunctivitis), sneezing episodes (rhinitis) and a dry cough (bronchial asthma) as early reactions. Known late reactions to pollen allergy include for example neurodermatitis or eczema. As well as the personal symptoms of sufferers, there are more far-reaching consequences such as loss of earnings or work incapacity during the pollen season or increased medical treatment costs, so that there is an immense need for a gridlike pollen guard for attachment in front of the windows and doors of living and working areas. Further information about pollinosis is available in

Ratgeber Pollenallergie, Ute Künkele, Munich 1992.

The most important properties a pollen guard for windows and doors must offer the user are sufficient ability to air the amenities, sufficient transparency for letting light in and for looking out, and an alleviating effect with regard to pollen allergy. The most important parameters for describing a pollen guard are accordingly air perviousness, optical transparency and filtering effect with regard to pollen.

Guard systems attached in front of windows and doors over the whole area thereof in order that the penetration of comparatively large objects such as insects into living areas may be prevented are known. DE 30 45 723 A1 describes for example net curtains, nets, filters or sieves for such a purpose that are attached to window or door frames by means of press studs. Owing to their relatively large mesh sizes of 1 to 2 mm, these possess good visual transparency and permit adequate airing of living quarters, but do not provide adequate protection against pollen dust (size about 10 to 50 µm) and fungal spores (size about 200 µm).

Filtration means whereby air is completely cleaned of pollen, germs and spores find use in airconditioning and automobiles. The high filtering effect is achieved in DE 39 04 623 A1 for example through the use of single- or else often multi-ply filter mats formed from unwovens which, owing to their fibrous nature, make the filter stage impassible to the abovementioned allergens. To intensify the contact of the particle-laden air with the filter, the laminate of filter mats is additionally folded in a zigzag shape. However, owing to their nonexistent visual transparency, such filter mats have no utility as a protective device for attachment in front of openings in buildings.

It is further possible to remove pollen from air flowing into an indoor amenity by means of a woven or loop-formingly knitted fabric solely by adjusting the mesh size. Sizes of most of the allergenic pollens occurring in Europe, essentially birch, grasses, goose-foot, wormwood, plantain, hazel, are in the region of 20 to 40 µm. The mesh size required for purely mechanical filtration is therefore at least 20 µm, and this is too small to provide adequate visual transparency.

A further window guard against pollen, germs and spores is disclosed for example in DE 43 00 422 A1. A textile material is attached in front of the windowpane, not

over the whole area thereof, but on the two wedgelike interstices and also the rectangular opening at the upper side of a window in tilt position. This form of attachment circumvents the problem of the nonexistent visual transparency of the textile material, but to completely open the window for airing purposes the textile material has to be removed by pivoting, so that there is no longer any protective effect.

None of the cited examples are able to achieve the properties of adequate visual transparency, air perviousness and filtration in a guard system against pollen.

A further problem is the attachment of the pollen or insect screen to the window, door or wall.

DE 196 47 451 A1 describes a hook having two legs for elastic flyscreens or the like, consisting of

a) two mutually adjoining regions forming the two legs, of which
b) the first leg, which is angular or angular with an end tapering to a point, is designed such that it is flat and can be adhesively bonded to a planar substrate, while
c) the second leg, which is flat and has rounded-off corners, is angled away from the flat, first leg such that, seen from the side, it forms an acute angle with the first leg.

This acute angle is in particular 5° to 89°, in particular 30° to 45°:

Also disclosed is the use of such a hook for reversible attachment of an elastic flyscreen or the like by adhering one such hook to each of the four corners of a window or door frame such that the second, angled-away legs of the hooks point diagonally outwards, so that the border of a flyscreen can be stretched over them. The flyscreen should be altogether elastic and/or its border should be elastic.

DE 196 47 450 A1 discloses a further use of adhesive hooks for suspending elastic flyscreens.

The adhesive hook comprises a barrier which is a mechanical barrier in the form of an antislip coating, abutment, grooves, jags or roughening and which prevents the flyscreen suspended thereon, or its border, slipping away from the wall.

It is disclosed therein that the adhesive hook consists of an adhesively attachable

base plate and of a hook part which is reversibly emplaced thereon, the adhesive hook being reversibly adhered by means of a stretch-recoverable adhesive film which has a tab bearing nonadhesive covers on both sides.

It is again of advantage when the flyscreen is altogether elastic and/or its border is elastic.

Suitable materials of construction for the hook equipped with antislip coating are generally materials having a high coefficient of friction with regard to the screen border's material of construction. Useful antislip coatings include in particular a polyurethane coating, for example Wolff Walsrode TPU VPT 2201 AU T 80, but also copolymers of ethylene and vinyl acetate (fraction not less than 10%), for example Bayer AG Levapren 456K, and also an emery paper coating, for example the 3M antislip product cat. no. 7639. But an antislip effect is also obtained through severe roughening of the surface of the material of construction, for example roughening of the polystyrene surface.

DE 197 38 672 A1 discloses adhesive hooks for flyscreens or the like which comprise a base plate endowed with a self-adhesive material on its backside. The frontside of the adhesive hooks is endowed with a device for redetachable reception of a support plate, the base plate fitting into an eyelet in the flyscreen and the support plate at least partly covering the flyscreen in the region of the eyelet.

The self-adhesive material used can be a foam-backed fixing tab, a film-backed fixing tab, a fixing tab comprising a carrier of fiber material, a carrierless pressure-sensitive adhesive material or a strippable system.

The adhesive hooks provide redetachable securement of a flyscreen by eyelets in the flyscreen each having a base plate projecting through them onto each of which a support plate is overgrippingly secured, the flyscreen being elastic in particular.

It is also known to use mushroom tapes for securing flyscreens to openings, for example window frames etc., in built structures. In the case of elastic flyscreens, these can be secured by means of hooks or holding pins comprising screws or nails.

WO 84/03536 A1 describes a fly curtain where the screen of individual strips arranged side by side in lamellalike fashion. The lamellae are secured to a frame

by means of adhesive tape. The identified apparatus has disadvantages, since the use of irreversibly detachable adhesive tape is complicated and not very secure. More particularly, it is very difficult, at installation, to orient the lamellae such that they hang vertically. Similarly, the achievement of a regular overlap between the lamellae is difficult. Furthermore, the use of irreversibly detachable adhesive tape is laborious, since such fly curtains are often only used for part of the year and hence are preferably regularly applied and removed again. Moreover, a stable construction for door openings is desired, since regular entry and exit constitutes a considerable stress on the securement of the lamellae to the frame.

It is a particular problem to secure pollen or insect screens to doors. The user of the screens wishes to pass through doors on a regular basis, so that a fixed installation of the screen is not possible or at least very impractical. The attachment of screens in the same way as with windows and as detailed above can thus be ruled out in most cases.

The present invention has for its object to provide a pollen or insect screen which is suitable in particular for attachment to doors, whose width is readily freely chooseable, which is simple and quick to attach and also which avoids or at least reduces the known disadvantages of the prior art.

This object is achieved by a pollen or insect screen as set forth in claim 1. Refinements of the screen according to the present invention form the subject matter of subsidiary claims.

The present invention accordingly provides a pollen or insect screen for applying to openings in buildings such as windows, doors or similar, consisting of a rail applied above the opening in particular, the rail comprising three or more substantially parallel guide devices which extend in the longitudinal direction of the rail, and also five or more substantially parallel screen strips movably mounted in the guide devices of the rail.

It is particularly preferable when each guide device extends almost over the entire length of the rail or frame and/or one or more screen strips are receivable in the guide devices so as to be slidable over almost the entire length of the rail.

The guide devices are in particular executed as a slot, these slots being able to receive a thickened part of the free end of each screen strip.
Preferably, especially two screen strips are provided per guide device/slot which are each pushable to one side to open the screen.
The guide devices, moreover, are preferably open at the side, so that the screen strips can be pushed into the guide devices/slots from both sides.

It is further preferable when at least a part of a wall of the slot consists of a lip-shaped part capable of enclosing a thickening of one end of the screen strip in the slot.

The lip constitutes stable securement for the screen strip in the slot. And compact construction can be achieved, since the lip forms at least a part of a wall between two adjacent slots. The thickening of the end of a screen strip can be formed by a strip folded into an edge of a lamella perpendicular to the longitudinal direction of the lamella, the strip being receivable in the slot. Preferably, the thickening is fixed by the manufacturer by soldering or gluing, so that vertical hanging is achieved.

The ends of the screen strips can then be held in position on the underside by means of weighting elements etc.

According to the invention, the screen strips can be slid over each other, so that a clear opening is formed, if desired.

The ratio of the number of slots to the number of screen strips determines the maximum size of opening achievable at the center when the screen strips are each pushed toward the outside. Five or six strips require three slots in order that the largest passageway may be achieved. Especially when the number of screen strips is large, there should be many slots in order that the curtain may be pushed open wide. The screen itself is thus made up of individual strips which are disposed in lamellalike fashion.

The individual strips are preferably provided at the upper end with a fixed device which can be hooked into a rail which is firmly or detachably anchored to the substrate above the door. This device is able to glide in the rail, so that, to open

the screen, for example the individual strips can be pushed to one side by moving said devices as desired.

It is advantageous for the manufacturer of screens according to the present invention that although doors do not have a standardized width and although the installation geometries for the rail at the doors can likewise be very different in each individual case, these rails can be offered in certain widths which the user can cut or saw to the actually desired or required width.

It is further preferable when the rail is fixed to the substrate by means of bolts, fastening tapes, double-sided adhesive strips, especially stretch-recoverable tapes of a bothsidedly adhering adhesive film, and/or by means of one or more fastening devices which each consist of a bottom plate and which in particular have a recess into which the rail can be hung.

Secure connection of the rail to the substrate requires the presence of three fastening devices which are each fixed to the substrate at the edge of the rail and also approximately in the center thereof.

It is particularly preferable when the bottom plate is emplaced on a base plate, an adhesive strip being adhered behind the base plate.

Furthermore, the rail, the fastening device and/or the bottom plate consist of plastics material (transparent or opaque) such as polyolefin (for example PE, PP), polyethylene terephthalate, polystyrene, ABS, polyester; polyamide, PMMA, polycarbonate; PVC or Resopal, but also wood, raw or all painted/glazed varieties, glass, metal or Eloxal.

Useful fastening systems include in particular double-sided adhesive tapes, as for example foam-backed fixing tabs, film-backed fixing tabs, tabs having a carrier of fiber material (wovens, nonwoven scrims, etc.) or carrierless systems comprising pressure-sensitive adhesive materials, as for example on the basis of acrylates, synthetic rubber, natural rubber or butyl rubber.

Suitable self-adhesive systems also include strippable adhesive systems as described in DE 33 31 016 C1, DE 42 22 849 A1, DE 42 32 709 A1,

DE 44 28 589 A1, DE 44 31 914 A1, DE 195 31 696 A1 (especially tesa power strip®) and also those described in US 4,024,312 A1, WO 92/11332 A1, WO 92/11333A1, WO 95/06691 A1.

If the fastening devices are to be fastened to the substrate by means of a double-sided adhesive strip, it is preferable to employ stretch-recoverable strips of a bothsidedly adhering adhesive film.

The strip then preferably consists of a highly stretchable, elastically or plastically elongation-deformable material, if appropriate with an intercarrier, especially with a film or foam intercarrier.
The adhesion of the strip should be less than the cohesion; the bonding ability should substantially disappear on elongating the film; and the ratio of peel-off force to breaking load should be not less than 1:1.5.
The strip is preferably a strip based on thermoplastic rubber and tackifying resins, of high elasticity and low plasticity.
The strips can be equipped to be pressure-sensitive adhesive on one side or both sides or else with a thermally activatable adhesive material on one or both sides. Their construction can be single layered or multilayered. In the case of bothsidedly pressure-sensitively adhesive self-adhesive tapes, elastically or plastically deformable materials can be used as intercarriers. These include not only polymeric films but also in particular adhesive compositions as interlayers and foam-containing intercarriers. In a preferred embodiment, the adhesive film has an intercarrier which is provided with an acrylate adhesive coating on both sides.

It is particularly advantageous to use the fastening device when the bottom plate is shaped such that it can be mounted onto a base plate, the base plate being adhered to the wall by the adhesive strip. For example, these base plates are commercially available, inter alia as adhesive hooks having a modular construction (tesa Power-Strips Systemhaken), consisting of a base plate onto which a hook body is adapted.
These base plates can be used to adapt bottom plates of a wide range of shapes which permit a large range of variations with regard to applications.

The base plate consists of a plate whose sides and/or front face comprise means

for securing to the bottom plate if appropriate and whose reverse face is adhered with a strip of preferably bothsidedly adhering adhesive film onto the substrate such that one end of the adhesive film projects beyond the plate as a grip, the adhesive film being such an adhesive film that the adhesive bond achieved thereby is redetachable by pulling which stretches the strip. Preferably, the base plate has at its end or its reverse face, at least in the region bearing against the grip of the adhesive film strip, a low stick and slip friction with regard to the adhesive film strip.

It is further preferable when the region bearing against the grip has a low energy surface, based on fluorous polymers, organosilicon polymers, polyolefins or based on polymers comprising fluorous segments, segments of organosilicon polymers or polyolefin segments, or those based on a mixture of the aforementioned polymers, if appropriate with further polymers.

It is further preferable when the region bearing against the grip has a surface tension of up to 37 mN/m.

It is further preferable when the region bearing against the grip is constructed together with the base plate as an integrated injection-molded part composed of plastics material.

It is further preferable when the reverse face of the base plate comprises spacers which are disposed to the side, above and/or below the adhered adhesive film strip and whose height is less than the thickness of the adhesive film strip.

It is further preferable when the spacers are situated to both sides of the adhered adhesive film strip.

It is further preferable for the spacers to be constructed as webs or segments.

It is further preferable when the spacers are constructed as an injection-molded part together with the base plate.

It is further preferable when the spacers have from 30% to 90% of the thickness of the adhered adhesive film strip when the adhesive film strip is 0.65 mm thick,

especially from 0.3 to 0.6 mm.

It is advantageous when the height of the spacers is chosen such that it is lower than the thickness of the adhesive film (unstretched), so that impeccable adhering to the adherend is possible. As the adhesive film stretches in the course of being detached, its width and thickness decrease accordingly. When the adhesive film thickness reached in the course of detachment is lower than the height of the spacers, tear-free detachment of the adhesive film will become possible even when high contact pressures occur concurrently vertically to the adhesive bond which would otherwise have led to tearing of the adhesive strip.

By using plates which comprise a material having very low stick and low slip friction coefficients with regard to the particular adhesive film used, on the grip side in the edge region of the adhesive bond, residueless detachment of the adhesive bond is possible even when the angle between the plane of the adhesive bond and peel-off direction is distinctly greater than 0°, especially about 45° to 135° and especially 60° to 100°.

The bottom plate can further preferably be equipped with an antislip coating. Suitable materials of construction are generally materials having a high coefficient of friction. Useful antislip coatings include in particular a polyurethane coating, for example Wolff Walsrode TPU VPT 2201 AU T 80, but also copolymers of ethylene and vinyl acetate (fraction not less than 10%), for example Bayer AG Levapren 456K, and also an emery paper coating, for example the 3M antislip product cat. no. 7639. But an antislip effect is also obtained through severe roughening of the surface of the material of construction.

Suitable materials for elastic and also nonelastic, preferably light-colored, especially white, screen knits/tulle are in particular UV-stabilized or UV-stable polymers such as polypropylene, polyester and polyamide. The knits have about 30 to 60 threads/5 cm along and across.

Elastic tulle knits consist for example of Elastane®.

The elasticity of the fly screen can be brought about in particular by a rubber band at the edge of the net or else by inherent material properties of the net. In the

latter case, the material concerned may be, for example, nylon-6,6.

Suitable for such fly screens are for example

	Tulle 1	Tulle 2
Feature	Fly screen with rubber band at net edge (honeycomb tulle)	Elastic fly screen
Material	Polyester (PET) (linear density: about 50 dtex)	Polyamide (nylon-6,6)
Weight [g/cm^2]	24	60
Thread count 5 cm (along)	36 holes[1)]	56
Thread count 5 cm (across)	17 holes[1)]	39
Tensile strength[2)] [N/cm](along)	31	373
Tensile strength[2)] [N/cm] (across)	9	19
Breaking extension [%] (along)	31	373
Breaking extension [%] (across)	71	179

[1)] An exact thread count cannot be given because of the honeycomb structure.

[2)] Measurements along the lines of German standard specification DIN 53815 (300 mm/min rate of extension).

Any colors desired for visual reasons are applied by painting with dark and/or light and further colors, spraying, printing or the like. Drawing patterns or templates may be utilized in the process; furthermore, motifs and patterns already applied on the tulle can be colored in like a coloring book.

The tulle may be endowed to phosphoresce partly or wholly, either through use of a phosphorescent thread in the course of weaving the tulle or, for example, through printing or spraying with a phosphorescent paint or an ink.
Similarly, the tulle may phosphoresce in areas as well as motifs.

Useful phosphorescent pigments include all pigments which glow in the dark after excitation by light, for example Lumilux chemicals from Riedel-de Haën. These are commercially obtainable in powder form and incorporated into paints and inks.

More particularly, these pigments are capable of phosphorescing in the colors blue, red and green.

When the screen is used as a pollen screen, properties such as air perviousness, visual transparency and adequate filtering effect with regard to pollen should be actualized. The pollen protective system or guard shall combine adequate filtration performance of 70 to 80% with regard to pollen and the like in the size region of about 20 to 40 μm with adequate ventilation and adequate visual transparency. Air perviousness and visual transparency are particularly important for living and working areas, since the air change rate on the one hand and the ability to allow people inside to look out and the letting in of daylight on the other all have to be ensured. Good values of air perviousness for acceptable ventilation of a room are of the order of not less than 20 000 $m^3/m^2/h$ given a differential pressure of 300 Pa. Adequate transparency is a transmission between 20 and 100%. The properties of adequate visual transparency and air perviousness are achieved through the use of a woven or loop-formingly knitted fabric having a sufficiently large mesh size.

The contrary property of an adequate filtering effect is achieved by applying a triboelectric charge to support the purely mechanical filtering effect after the fabric has been placed in front of the window or door opening. A similar approach is disclosed in DE 44 14 728 A1, where the charging of net-type wovens in synthetic high-polymeric fibers is used to create, between the allergen and the fabric, an electric field which is to be utilized for filtration. However, no details are provided as to how the electrostatic charge is supposed to be applied, nor of the relationship between the contrary properties of air perviousness and visual transparency on the one hand and filtration performance on the other.

The principle of applying a triboelectric charge is based on the separation of charges, brought about on a macroscopic scale by rubbing or separating at least two materials. The sign and the magnitude of the charge are determined initially by the escape energies W_a of the near-surface electrons of the materials, since near-surface electrons escape from the surface of one material and pass into that of the other. Consequently, an electron deficiency will develop in the surface of one material, causing this surface to become positively charged, whereas the other surface acquires a negative charge due to the excess electrons. It is

discernible from "Elektrostatische Aufladungen begreifen und sicher beherrschen" (Lüttgens/Glor, 2nd edition that for very rapid and high charging of materials, as envisioned in the invention, the difference in their electron escape energies has to be very large.

As well as the electron escape energies, other parameters affecting a process of triboelectric charging are such as the temperature, roughness and degree of contamination of the surfaces, the rubbing or separating speed and also the humidity.

The discharging of the electrostatic charge is suppressed when the volume resistance, and also the surface resistance, of the materials is on the order of 10^{12} to 10^{15} Ω. The woven or loop-formingly knitted fabric therefore preferably utilizes fibers, or coatings applied to the fabric, having surface resistances of 10^{12} to 10^{15} Ω.

Electrostatic charging by charge separation may be effected for example by the rapid removal of a polymeric film attached to the screen, on either or both sides, over the whole area thereof without air inclusions. Charging is likewise possible by the friction of particle-laden air against the fabric when air is passed at high blown at high volume flows speed through the fabric by means of a hand-held hair-dryer, an industrial air blower, including a hand-held industrial air blower, a ventilator or a fan.

The preferred way is to manually rub a polymeric or natural material against the fabric after it has been attached in front of the window.

The electrostatic charge is preferably not applied by applying an external voltage. Nor is the maintenance of the charge achieved through the external application of a potential, but solely through the triboelectric charging and the choice of the polymeric properties. In the event of a discharge occurring, for example as a result of increased atmospheric humidity or rain, the charge can be reestablished after the precipitation by drying and subsequent rubbing with appropriate polymeric material. Another possibility is to dry and recharge in one operation, solely by using a hair-dryer to blow particle-laden air through the fabric.

As well as utilizing electrostatic charging for filtration of pollen, the invention also makes possible the properties of adequate air perviousness and sufficient visual transparency, since the mesh size required for filtration can be enlarged beyond the pollen diameter.

It is preferable to use a textile fabric as screen.

Textile fabric refers to the totality of ways of producing textiles from yarn material by conventional fabric-forming operations such as drawn-loop knitting, formed-loop knitting or weaving. The fundamentals of textile fabric-forming operations can be read up in Alfons Hofer: "Stoffe 2", 1983, Deutsch Fachbuchverlag or "Kettwirkpraxis", No. 4, 1970, pages 19 to 20, Technologien der Kettwirkerei.

The texturing of yarn material is primarily used for textile fabrics formed from manufactured fibers such as polyester or polyamide in order that a character akin to a natural fiber may be conferred on the artificial fibers. Manufactured fibers differ from natural fibers, with regard to the spinning of the yarns, in the length of the filaments to be spun into yarns. Manufactured fibers utilize continuous filaments which, after spinning into yarn, have a parallel position relative to each other and confer a smooth, unnatural feel on the yarn. The filament length of natural fibers is substantially shorter and only amounts to a few centimeters. When short filament lengths are spun into yarn, as is the case with cotton for example, it acquires bulk by virtue of protruding filament ends.

The texturing of yarn material composed of artificial continuous filaments can be effected for example by deforming the filaments from their parallel position by torsion or bending with subsequent heat setting. An example is the so-called false twisting process [Grundlagen der Textilveredelung", 13th revised edition, Deutsch Fachbuchverlag 1989].

The use of a textile fabric having textured threads has the advantage over the cited approach of achieving a filtration of pollen solely through the reduction in mesh size that a higher filter performance can be achieved without the process-side reduction in mesh size, since the filaments of the textured thread narrow the actual mesh size and thereby create spacings between the filaments that are

impassable for pollen. In addition, the bulking of the threads results in the two-dimensional fabric being extended into the third dimension. The textured threads thus on the one hand, through a longer flow path, extend the contact time of the air with the filter material and on the other enlarge the filter surface area, which leads to improved filter properties.

This permits for example a higher air perviousness which enables improved airing of the amenities, since the mesh size does not have to be reduced to the diameter of the pollen to be filtered to achieve filtering.

It is further preferable to use a spacer textile as screen.

Spacer textile refers to the totality of ways of producing three-dimensional textile structures from yarn material without wishing to restrict the invention which is to be protected to any one fabric-forming operation such as drawn-loop knitting, formed-loop knitting or weaving.

The loop-formingly knitted spacer fabric is to serve as an example to illustrate the production of three-dimensional loop-formingly knitted or woven structures without wishing to restrict the invention. Loop-formingly knitted spacer fabrics can be described as three-dimensional loop-formingly knitted structures. A loop-formingly knitted spacer fabric consists of two loop-formingly knitted webs which are produced from two ground threads and which are interknitted by perpendicular pile threads disposed in between the webs, and thus acquire a spacer structure. In some instances, adhesive technology is likewise used to join the outer loop-formingly knitted structures together. The two outer loop-formingly knitted structures can be fabricated independently of each other and have a wide variety of mesh sizes and different interlooping techniques, so that the most diverse possible combinations and designs are possible in the field of loop-formingly knitted spacer fabrics. The fundamentals of textile fabric-forming operations can be read up in Alfons Hofer: "Stoffe 2", 1983, Deutsch Fachbuchverlag or "Kettwirkpraxis", No. 4, 1970, pages 19 to 20, Technologien der Kettwirkerei.

The use of a loop-formingly knitted spacer fabric likewise has the advantage over the cited approach of achieving a filtration of pollen solely through the tight mesh size that the mesh size can be increased, since the filtering effect comes about

through the extended flow path and the associated longer contact with the filter material.

This likewise permits for example a higher air perviousness which enables improved airing of the amenities, since the mesh diameter does not have to be reduced to the diameter of the pollen to be filtered.

It is further preferable for the textiles to be napped by a napping operation following the fabric-forming operation. Napping is generally accomplished by passing the textile web over teasels, which are usually realized as rolls equipped with sharp edges, such as blades or steel brushes. In napping, individual filaments of the yarn material are severed and pulled out of the yarn, whereas the other filament end remains in the yarn. Further details can be found in Peter/Rouette: "Grundlagen der Textilveredlung", Deutscher Fachbuchverlag Frankfurt, 1989.

The use of a napped textile fabric has the advantage over the cited approach of achieving a filtration of pollen solely by reducing the mesh size that a higher filtering effect can be achieved without process-side reduction in the mesh size, since individual severed filaments of the yarn protrude into the mesh and reduce the area of a mesh through which flow can take place. This creates spacings between the filaments that are impassable for pollen. In addition, the raising of the filaments results in the two-dimensional fabric being extended into the third dimension. The raised filaments thus on the one hand, through a longer flow path, extend the contact time of the air with the filter material and on the other enlarge the filter surface area, which leads to improved filter properties.

This likewise permits for example a higher air perviousness which enables improved airing of the amenities, since the mesh size does not have to be reduced to the particle diameter to achieve filtering.

The pollen or insect screen of the present invention offers many advantages.

The screen is especially suitable for application in front of doors since the width is readily freely choosable by the number of screen strips or guide devices being chosen appropriately. Furthermore, the width can be varied by varying the overlap

of the strips. The system is thus very flexible.
In addition, the comparatively small fastening devices make the screen simple and quick to attach.

The invention is not restricted to the illustrative embodiments described, but can of course comprise various versions and modifications within the realm of the scope of protection conferred by the claims which follow.